REMARKS

This application has been carefully reviewed in light of the Office Action dated January 12, 2004. Claims 1, 3, 5 to 13, 15, 17 to 25, 27, 29 to 37, 39 and 41 to 48 remain in the application, with Claims 2, 4, 14, 16, 26, 28, 38 and 40 having been canceled. Claims 1, 13, 25 and 27 are the independent claims herein. Reconsideration and further examination are respectfully requested.

Applicant wishes to thank the Examiner and her supervisor for the courtesies extended to Applicant's representative during the June 8, 2004 telephonic interview. This Amendment has been prepared giving due consideration to the points noted in the Office Action and based on the foregoing interview.

In the Office Action, Claims 1 to 48 were rejected under 35 U.S.C. § 101 for an alleged lack of utility, under 35 U.S.C. § 112, first paragraph, for an alleged lack of enablement, and under 35 U.S.C. § 112, second paragraph, for an alleged lack of clarity. Without conceding the propriety of the rejections, the claims as amended are believed to overcome all of the foregoing rejections. More particularly, with regard to the § 101 rejections, the amended claims clearly recite a utility that is fully supported by the specification (e.g., classification of signals to distinguish alleles from background signals of PCR processing). With regard to the § 112 rejections, the claims have been amended for clarity as suggested by the Examiner and her supervisor to utilize language that which is clearly described in the specification. In view of the foregoing, reconsideration and withdrawal of the § 101 and § 112 rejections are respectfully requested.

Claims 1 to 48 were rejected under 35 U.S.C. § 103(a) with Claims 1 to 3, 13 to 15, 25 to 27 and 37 to 39 having been rejected over Ewing, Claims 5 to 9, 17 to 21, 29 to 33, and 41 to 45 having been rejected over Ewing in view of Youseff, Claims 10, 11,

22, 23, 34, 35, 46 and 47 having been rejected over Ewing in view of Curram, Claims 12, 24, 36 and 48 having been rejected over Ewing in view of Youseff and Curram, and Claims 4, 16, 28 and 40 having been rejected over Ewing in view of a newly-cited article to Allex, et al., entitled "Neural network input representations that produce accurate consensus sequences from DNA fragment assemblies." Reconsideration and withdrawal of the rejections are respectfully requested.

The present invention identifying and classifying nucleic acid. According to the invention, a gel electrophoresis process is performed on nucleic acid material and a machine-readable image is generated from the results of the gel electrophoresis. The machine-readable image is generated in a spatial domain of size versus intensity. The spatial domain machine-readable image is transformed to a frequency domain by executing a frequency transform (e.g., Hadamard, Fourier, or wavelet transform) on the spatial domain machine-readable image. The frequency transform process results in frequency coefficients that each correspond to a spatial domain value of the spatial domain machine-readable image. A classification process is then performed on the frequency coefficients (e.g., the frequency coefficients are processed in a connectionist neural network algorithm) so that signals that represent alleles can be distinguished from background noise signals that inherently result from PCR processing. As a result, the present invention provides a technique for classifying nucleic acid data that (1) is more accurate than conventional techniques, and (2) is faster than conventional techniques since the amount of data run through the classification process is reduced due to the frequency transformation.

Referring specifically to the claims, amended independent Claim 1 is a method of identifying and classifying data obtained from the analysis of nucleic acids, comprising the steps of performing a gel electrophoresis process on nucleic acid material

and generating a machine-readable image of results of the electrophoresis process, wherein the machine-readable image is in a spatial domain of size versus intensity, executing a frequency transform on the spatial domain machine-readable image to transform the spatial domain machine-readable image to a frequency domain, thereby obtaining frequency coefficients corresponding to spatial domain values, and executing a pattern-based classification process on the frequency coefficients in order to distinguish alleles from background signals of PCR processing.

Amended independent Claims 13, 25 and 27 are apparatus, computer-executable process steps and computer-readable medium claims, respectively, that substantially correspond to Claim 1.

The applied art, alone or in any permissible combination, is not seen to disclose or to suggest the features of Claims 1, 13, 25 and 27. More particularly, the applied art is not seen to disclose or to suggest at least the feature of executing a frequency transform on a machine-readable image in a spatial domain of size versus intensity to transform the spatial domain machine-readable image to a frequency domain, thereby obtaining frequency coefficients corresponding to spatial domain values, and executing a pattern-based classification process on the frequency coefficients in order to distinguish alleles from background signals of PCR processing.

Ewing is seen to disclose a base-calling program that performs the following: 1) inputting a chromatogram file, 2) normalizing the data of the chromatogram to form a skyline projection, 3) performing peak prediction to predict the ideal location of base peaks, 4) locating actual observed peaks, 5) matching the observed peaks with the predicted peaks, and 6) finding missed peaks. Applicant submits that steps 1 and 2 of Ewing may be seen to correspond to the first step of the claimed invention. However, the

remaining steps of Ewing are significantly different from the second and third steps of Claims 1, 13, 25 and 37.

In this regard, Ewing's step 3) performs peak prediction by examining trace arrays to detect the location of maximum values, and then uses Fourier methods to form a sine wave that represents a predicted peak pattern. Thus, the peak prediction process of Ewing merely uses Fourier methods to generate a sine wave. However, Ewing is not seen to use Fourier methods, or any other type of frequency transform, to transform a machine-readable image in a spatial domain of size versus intensity to a frequency domain, thereby obtaining frequency coefficients corresponding to spatial domain values.

Moreover, Ewing is not seen execute a pattern-based classification process on the frequency coefficients in order to distinguish alleles from background signals of PCR processing. Rather, the remaining steps of Ewing simply locate actual observed peaks, match the observed peaks with the predicted peaks, and then finds missed peaks. None of these steps are seen to correspond to executing a pattern-based classification process on the frequency coefficients in order to distinguish alleles from background signals of PCR processing.

Youssef, Curram, and Allex are not seen to add anything that, when combined with Ewing, would have overcame Ewing's deficiencies or that would have rendered the present invention obvious. In this regard, Youssef is merely seen to disclose the use of various data compression techniques, such as Fourier transforms, DCT (Discrete Cosine Transforms), Hadamard transforms and Wavelet transforms, to transform data. None of these techniques are new, nor is Applicant claiming to have invented a new frequency transform. Rather, Applicant has claimed as part of his invention the use of various known frequency transforms in a process for classifying and identifying data

obtained from the analysis of nucleic acids. More particularly, Applicant has claimed as part of his invention executing a frequency transform on a machine-readable image in a spatial domain of size versus intensity to transform the spatial domain machine-readable image to a frequency domain, thereby obtaining frequency coefficients corresponding to spatial domain values, and executing a pattern-based classification process on the frequency coefficients in order to distinguish alleles from background signals of PCR processing. Any permissible combination of Ewing and Youssef would not have resulted in the present invention. Rather, at best, utilizing any of the known frequency transforms disclosed by Youssef in Ewing would merely have resulted in a different way to obtain the predicted peaks. But such a combination would not have resulted in the presently claimed invention.

Curram is also not seen to add anything to overcome the deficiencies of Ewing and Youssef. In this regard, Curram is merely seen to disclose the use of neural networks in data analysis. However, neither Ewing nor Youssef disclose anything with regard to a need for, or a use of, a data mining process of any type, much less the need for a neural network. Moreover, Applicant has amended the claims to more clearly recite that the process is a pattern-based classification process executed on the frequency coefficients in order to distinguish alleles from background signals of PCR processing. None of Ewing, Youssef or Curram are seen to disclose any such process.

Allex is merely seen to disclose the use of neural networks in DNA analysis. However, one problem with Allex is the use of raw data in the neural network, a problem that the present invention is designed to address. As discussed in the specification of the subject application, the use of raw data in a neural network results in inaccurate allele classification, as well as time consuming calculations. In contrast, the present invention

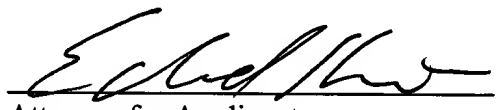
uses frequency coefficients obtained by transforming the raw data into a frequency domain. As discussed in the specification, this process produces more accurate classification results, and results in a much faster classification process due to the reduction of data. Thus, Allex is not seen to add anything that, when combined with any of Ewing, Youssef, or Curram, would have resulted in the present invention.

In view of the forgoing amendments and remarks, amended independent Claims 1, 13, 25 and 37, as well as the claims dependent therefrom, are believed to be allowable.

No other matters having been raised, the entire application is believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

Applicant's undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



Attorney for Applicants

Registration No. 42,746

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-2200
Facsimile: (212) 218-2200

CA_MAIN 82224v1